Remarks:

Reconsideration of the present application is respectfully requested.

Claims 1-3 stand rejected under 35 U.S.C. 102(e) on the basis of Gaessler et al. Claim 1 has been amended to recite that the second mode of operation includes at least two fuel shots per engine cycle. Gaessler does not teach or suggest more than one fuel shot per engine cycle, and the rejection is therefore overcome and withdrawal of the same is respectfully requested. The rejections of claims 2 and 3, which depend from claim 1, are overcome for similar reasons.

To emphasize distinctions similar to those of claim 1, Claim 5 has been amended to recite that the second number of fuel shots is different from that of the first set.

Claims 13, 15 and 16 are also rejected under 35 U.S.C. 102(e) based on Gaessler et al. Claim 13 has also been amended to recite that the first set of fuel delivery characteristics comprises "a number of fuel shots," and that the second set of fuel delivery characteristics is different from the first set. The Examiner has identified no teaching in Gaessler of fuel delivery characteristics including number of fuel shots. Similar to claim 1, there is no teaching or suggestion in Gaessler to base fuel delivery characteristics on a number of fuel shots, and withdrawal of the 102(e) rejection to claim 13 and the claims dependent thereto is respectfully requested.

Claims 1-20 are rejected under 103(a) based on the proposed combination of Yang et al. (Yang '054) and Marriot et al. The rejections are traversed, for the reason that even if each of the limitations set forth in Applicants' claims 1-20 might be found in the cited references, the requisite motivation to combine the references to arrive at Applicants' claimed invention is lacking. Yang and Marriot teach fundamentally different engine types and operating methods. One of skill in the art, viewing the teachings of the two references, would not be motivated to combine them in the way asserted in the office action, and thus no proper prima facie case of obviousness has been made, and the rejections should be withdrawn. Combining the teachings of Yang '054 and Marriot in the manner proposed in the Office Action would result in a contraption totally unworkable, or at least far different from the scope of Applicants' claims.

The Examiner states that Yang '054 teaches transitioning between "two types of fuel injection modes." Applicants' respectfully, but earnestly disagree. There is not a single utterance in Yang '054 of "fuel injection" or illustration of fuel injector hardware. As such, the reference cannot fairly be said to teach something not illustrated or even mentioned therein. Applicants readily concede that fuel injection is a known means of delivering fuel, and that the term "fuel injection" appears in U.S. Patent No. 6,295,973 (Yang '973), incorporated by reference in Yang '054. Bare mention of fuel injection in the incorporated reference, however, cannot be readily

attributed to Yang '054, and then go on to assert that Yang '054 teaches two fuel injection modes, particularly where the incorporated reference, Yang '973 is entirely directed to carbureted fuel delivery. Consequently, one of ordinary skill would not view Yang '054 as teaching transitioning between fuel injection modes at all, as asserted by the Examiner. If anything, where the reference is properly considered as a whole, Yang '054 would be understood as teaching only a carbureted fuel delivery system, and transitioning between two carbureted operating modes, HCCI and SI.

The Examiner further states that it would have been obvious to incorporate the two shots per engine cycle of Marriott into the engine of Yang '054 for "better timing" of fuel ignition in HCCI mode. While Applicants concede that one might improve ignition timing in a HCCI carbureted system (Yang) by introducing a small diffusion burn via fuel injection, such as is taught by Marriott, this approach is not what Applicants have claimed. Thus, on this basis alone, i.e. carbureted operation versus fuel injection operation, Applicants respectfully assert that one of ordinary skill in the art would not be motivated to combine the references to arrive at the invention of any of claims 1-20. A fair combination of the references might be to change the carbureted HCCI mode of Yang to a Carbureted HCCI mode that includes an ignition injection as per Marriott et al. But again, this is not what Applicants have claimed. There is no evidence of record that one with ordinary skill would be motivated to completely drop the carbureted fuel system of Yang in favor of fuel injection to arrive at Applicants' claimed invention. And even if they were, such a modification would be forbidden by the MPEP and relevant case law as a modification against the teachings of the cited reference.

Even if Yang could properly be characterized as teaching fuel injection, which it cannot, one of skill in the art would have no motivation to undertake the substantial design and operating changes required to arrive at Applicants' claimed invention. Those with ordinary skill recognize that ignition timing in an HCCI engine is varied preferably by adjusting compression ratio via varying the timing of one or both of the exhaust or intake valves, not by varying the timing of injection. In Marriott, there will indeed be some premixing of fuel and air relatively early in the injection cycle; however, the second, additional injection is much more like a conventional diffusion burn, injected close to top dead center that ignites the lean pre-mixed fuel/air charge. Marriott et al. even admit in their disclosure that premixing is compromised by the introduction of the additional charge. At paragraph 13 of the Marriott disclosure, it is stated: "the later injection largely obviates homogeneity by creating a highly stratified, locally richer region within the combustion chamber" so that the lean pre-mix can be ignited. One with ordinary skill would likely be motivated to better control compression ratio if ignition time were a problem with HCCI operation, rather than compromise on emissions as per Marriott et al. by shifting some of the

delivered fuel to a diffusion burn injection to better control ignition timing of the premixed charge.

However, even if Yang '054 did in fact teach what the Examiner asserts, i.e. HCCI fuel injection, and Marriott indeed taught an HCCI ignition timing strategy, one of skill in the art would still not be motivated to combine the references to arrive at Applicants' claimed invention. While Applicants concede that Yang does indeed teach transitioning between operating modes, and Marriott teaches multiple fuel shots, the test for obviousness is not whether particular elements of the references could possibly be reconfigured into Applicants' claimed invention. To support a proper obviousness rejection, there must be some motivation to proceed as the Applicants have done, which is lacking in the present case.

Contrary to the Examiner's assertion, the references do not, alone or in combination, suggest that applying the dual injection strategy of Marriott would improve ignition timing in Yang '054. If anything, one of skill in the art would conclude that operation, including ignition timing and emissions, could be compromised by attempting multiple fuel injections in Yang '054. Yang '054 provides a first operating mode, an HCCI mode, and a second, spark-ignited mode. Control over spark timing by definition provides control over ignition timing. Control over ignition timing in HCCI operation is preferably controlled via compression ratio, such as via a variable intake valve. Marriott et al. teaches an alternative ignition in an engine which is not true HCCI by igniting the premix with a conventional injection in the vicinity of top dead center. This fact is a compromise against true HCCI operation. While Applicants recognize that Yang '054 transitions to the spark ignited mode from the HCCI mode in part because of ignition timing problems, there is simply no suggestion or teaching of the references, or knowledge in the art generally, that modifying Yang '054 to include a fuel injector, or adding fuel injections (if, arguendo, Yang '054 is considered to even teach fuel injection) would improve ignition timing. Ignition timing in a single shot HCCI engine is best controlled via compression ratio, which Marriott et al. do not do. Marriot et al. compromises on emissions in order to control ignition of the lean premix via a conventional injection diffusion burn. Importing Marriott's injection/ignition strategy to Yang '054 would at least partially compromise emissions quality originally sought by Yang. Therefore, Yang would more likely be motiviated to conserve his emissions advantages due to HCCI by seeking out compression ratio control strategies.

In addition, Yang '054 states at Column 1, line 35 that, as engine load increases in an HCCI engine, ignition timing tends to advance. The Examiner has provided no explanation for how a second fuel charge could somehow improve early ignition timing. In this instance, it plainly would not. If one were to attempt to solve late ignition problems with an additional fuel

injection, the homogeneity of the charge mixture would be compromised. Thus, there would actually be a disincentive to combine the references.

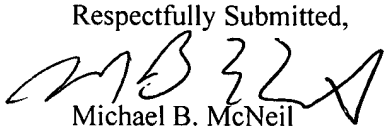
Finally, Yang '054 teaches a gasoline engine, whereas Marriott teaches a diesel engine. This would provide yet a further disincentive to modify Yang '054 as the Examiner suggests. It is well known in the art that ignition timing is fundamentally different in a gasoline engine such as Yang '054 versus a diesel engine such as that taught by Marriott. Among other things, the requisite compression ratio for gasoline compression ignition is substantially different than for diesel compression ignition. Gasoline is formulated to *avoid* compression ignition or knock, whereas diesel is formulated to *promote* compression ignition. At minimum, switching fuels, or attempting to apply teachings suitable for one fuel type to the other fuel type would require innovation beyond ordinary skill. For example, an entirely different control strategy including valve opening and closing times to account for the different autoignition characteristics of diesel versus gasoline. In addition, because the primary purpose of HCCI is to allow mixing of fuel before autoignition conditions develop, introduction of another fuel charge would not only compromise homogeneity of the combustion charge in the cylinder, it could affect the actual timing of autoignition itself, another variable for the designer to attempt to control. Thus, it simply cannot be reasonably argued that providing fuel at a second time, whether by injection or via a carburetor, could be an obvious modification of Yang '054 to arrive at Applicants' claimed invention.

Implementation of the combination spark-ignited, dual injection, HCCI, carbureted engine that would result from the Examiner's proposed combination, and teach all the limitations of Applicants' claims cannot be said to be within the capability or inclination of one of ordinary skill in the art. Much less could such a chimera be considered obvious. Thus, because there is no teaching or suggestion to combine and/or modify the cited references as proposed by the Examiner, the rejections to claims 1-20 are overcome, and withdrawal of the same is respectfully requested.

Applicants' claims 18-20 fall still further afield from the teachings of the cited references. Claim 18 is directed to a specific method for gradually switching over sets of cylinders from a mode having two fuel shots to a mode having a single fuel shot. In particular, two shots are initially delivered to all six cylinders in engine cycle, then to three cylinders in a second engine cycle, then 2 then 1, until finally all six cylinders are running in a single fuel shot fashion. The Examiner has identified no teaching or suggestion in the cited references of the specific claimed strategy, and withdrawal of the rejections is therefore respectfully requested.

This application is believed to be in condition for allowance of claims 1-20. No additional fees are believed to be due at this time, however, the director is hereby authorized to deduct any underpayment or credit any overpayment to Deposit Account No. 500226 if an extension of time is deemed necessary. If the Examiner believes that some minor additional clarification would put this application in even better condition for allowance, the Examiner is invited to contact the undersigned attorney at (812) 333-5355 in order to hasten the prosecution of this application.

Respectfully Submitted,



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